

START

0022224



DOCUMENT REVIEW: REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN FOR THE 100-BC-5 OPERABLE UNIT,
HANFORD SITE

Commentor Codes: IT = International Technology, HAZWRAP = DOE/HQ-DP contractor, HQ-EH = DOE Headquarters, S&W = Stone and Webster, RL = DOE Richland Operations

1. General Comment: Work Plans have been developed for source operable units within the 100-BC area but their relationship to this document is not clear. (HAZWRAP)
2. General Comment: The Work Plan is heavily weighted toward field investigations and sampling procedures and little information is provided about the types of analytical models that will attempt to use these data. The analytical and empirical models are the fundamental tools that are designed to assist in development of risk assessment and indications of potential adverse environmental impacts. These models serve as one basis for designing the field sampling and data collection program. (HAZWRAP)
3. p 1-4, Sec. 1.3, 2nd paragraph: This paragraph is supported nowhere else in the document and should be expanded. (HAZWRAP)
4. Figure 1-2: Provide discussion as to the selection criteria for establishing the 100-BC-5 site boundaries in this configuration. (HAZWRAP)
5. p 2-9, 2nd paragraph: This paragraph contains the first reference to "pluto crib." Presumably this refers to a location where plutonium was placed, but it is not explained in this first use or in the glossary. Please clarify. (HAZWRAP)
6. p 2-9, Sec. 2.1.3: The types of waste listed are not consistent with the titles of the sub-sections discussing the process generating the waste. (editorial) (S&W)
7. p 2-9, Sec. 2.1.3, 1st paragraph: Waste-Generation Processes contains extensive discussions and descriptions of the location and type of processes associated with former site activities. The problem is that this information is supported by very few references, no records, surveys, interviews, studies, reports, or other documentation is revealed to lend credibility to the text. It is suggested that this material be better supported, so that the correctness of this material can be established by independent review. (HAZWRAP)
8. p 2-10, Section 2.1.3.1.1, 3rd & 4th paragraphs: Figure 2-1 does not show any water pipes from 190-C to the C reactor. (S&W)

9. p 2-11, 1st paragraph: Nitrogen does not fission; Tritium may be produced as a fission product in U-235 fueled reactors, or tritium might be produced by a (n, ³He) reaction, but nitrogen doesn't fission. Please correct. (HAZWRAP)
10. p 2-11, 2nd paragraph: Summary descriptions of the unlined trenches (116-B-1 and 116-C-1) or the pluto cribs (116-B-3 and 116-C-2) are not included in Table 2-1. These are considered significant source units and therefore, should be listed in the table. (HAZWRAP)
11. p 2-12, 2nd paragraph:
 - The term "cuno filter" is first used here. It is not defined here or in the glossary. Please define.
 - An explanation is needed as to why these unlined ponds are not numbered waste units when virtually everything else at Hanford has a number. The fact that the ponds can be observed in aerial photographs is interesting but it implies that other information is not revealed. It should be clarified whether the ponds are identifiable/reachable on the ground or whether vegetation has covered the site, etc. (HAZWRAP)
12. p 2-12, Sec. 2.1.3.3, 1st paragraph: Numerous common-use terms appear in the first paragraph. However, poison-pieces, gun barrels, thimbles, and pigtails should be defined in the narrative and/or glossary. (HAZWRAP)
13. p 2-13, Sec. 2.1.3.3, 1st paragraph: Attempt to quantify "large volumes" with an estimated amount. (IT)
14. p 2-19, 1st paragraph, line 2: Change "100-BC-4" to "100-BC-5". (IT & HAZWRAP)
15. p 2-19, 1st paragraph: It is stated here and earlier in the text that the solid waste disposal sites in the 100-BC-3 and 100-BC-4 source operable units are not expected to have a major effect on groundwater. This statement is suspect given the current level of knowledge of these sites. Data on waste volumes, disposal practices, potential for leachate generation and percolation, and site hydrogeology must be evaluated to assess the potential impact from these solid waste disposal sites. (HAZWRAP)
16. p 2-20, Sec. 2.2.2.1.1, 1st paragraph: Provide or develop a generalized cross-section of the Hanford Site with more relevant transect and references than 200 West and 200 East if available. One which depicts the 100 Areas would be more appropriate. (IT)
17. Table 2-2:
 - 199-B3-2 - reported monitoring interval disagrees with Figure 2-7.
 - 199-B3-2P - depth to bottom appears to be wrong.
 - 199-B3-2Q - depth to bottom appears to be wrong.
 - 199-B4-2 - reported monitoring interval disagrees with Figure 2-9.
 - 199-B9-1 - drill depth appears to be wrong. (IT)

18. p 2-25, Sec. 2.2.3.2.2, 1st paragraph: In the following text I can only find references to hydraulic conductivity for the unconfined aquifer. This section suggests that it is available for all 6 principle units. Supply the data or modify the sentence. (S&W)
19. p 2-26: A summary description of the "blue clay" unit which separates the upper confined system and the unconfined aquifers should be given. Include lithology, thickness, variability and estimated hydraulic conductivity (if known). (all reviewers)
20. p 2-26, 6th paragraph: This paragraph states "three orders of magnitude," but has " 10^{-1} to 10^{-2} " (only one order of magnitude). (HAZWRRAP)
21. p 2-27, Sec. 2.2.3.2.3, 1st paragraph: It is stated that "The upper surface of the unconfined aquifer is in silty sandy gravels of the Hanford Formation": Does the top of the water table extend into the Hanford Formation? If it does, then Figure 2-18 is incorrect because it shows the hydrostratigraphic unit coinciding with the top of the Ringold Formation, i.e. the hydrostratigraphic and formational boundaries are common which is not the case. (HQ-EH)
22. p 2-28, 1st paragraph:
 - Cite reference for comparison of Ringold Formation and Saddle Mountain basalt potentiometric surfaces. (IT)
 - It is unclear as to what "...bulk water table elevation..." means. Is this the water table of the shallow unconfined aquifer? Please clarify what you mean by this statement. (S&W)
23. p 2-28, Sec. 2.2.3.2.5, 1st paragraph: Reference hydrographs for offsite wells as figure 2-22. (IT)
24. p 2-29, Section 2.2.4.2, 1st paragraph: This paragraph states that the springs flow rate is "... as low as 3 cft/s...". This indicates that a range of estimates of flow rate is available to quantify the flow rate. (S&W)
25. 2-30, Sec. 2.2.4.4, 1st paragraph: The reference for calculating a theoretical maximum flood of 1.4 million cubic feet per second should be U.S. Corps of Engineers, 1969. This flow rate would result in flood elevations of 423 ft AMSL at the 100-N Area. (IT)
26. p 2-39, Sec. 2.2.7.2, 1st paragraph: List and locate the three archaeological sites in the vicinity of the 100-B/C area. (IT)
27. p 2-39, Sec. 2.2.7.3, 1st paragraph: Expand on the cultural significance of the Gable Butte Cultural District. (IT)
28. Figure 2.1: The following locations/buildings/crypts can not be found on Figure 2-1:
 - 106-B; 116-B-10; 116-C-4; 116-C-5; 118-B; 185-B; 1701-B;
 - 1702 B; 1705-B; 1707A B (Figure 2-1 has a 1707-BA is this

the same?); 1707-B-B; 1709-B; 1720-B; 1736-B; 1902-B; 1901-B; 116-B-7; 132-C-1 (has been demolished but the rectangle is not cross-hatched to denote demolished facilities); 1702-C; and 1736-C. Also, the figure does not show any water pipes from 190-C to the C Reactor. (S&W)

29. Table 2-1: The last entry stated no structures are located within the 100-BC-3, 100-BC-4 source operable units yet Figure 2-1 shows structures that are designated as currently onsite. (S&W)
30. Figure 2-15: The vertical exaggeration should be 5X, not 10X. (IT)
31. Figure 2-19: It would help to have Gable Butte identified on this figure. It would then make more clear the discussion on groundwater flow (Section 2.2.3.2.3, middle of the page) where reference is made to Gable Butte. (HQ-EH)
32. Figure 2-21: Well names not consistent between text, title, and legend. Correct or include cross-reference. (IT)
33. Figure 2-23:
 - List vertical exaggeration (IT)
 - left side of the graph is labeled "Distance Above Mean Sea Level". For consistency, change "Distance" to "Elevation". (S&W)
34. Table 3-1:
 - Confusing contradiction. Status of 118-B-9 Storage Building is reported as inactive; however, it is stated in Waste Received column that the building is currently being used to store slightly contaminated reactor components from B & C Reactors. (IT)
 - Many of the facilities have reported years in service spans but no reported status, e.g., 120-B-1, 124-B01, 124-B-3, 126-B-1, 128-B-1, 132-B-2. (IT)
35. p 3-8, 2nd paragraph: Make clear that soil radiological inventories shown in Table 3-2 are the result of calculations performed using the soil and groundwater sampling data. (IT)
36. p 3-11, Sec. 3.1.1.2.3, 1st paragraph: Discuss and locate on Figure 3-1 the location of the 118-C-2 Ball Storage Tank. (IT)
37. p 3-11, Sec. 3.1.1.2.3: Are these balls are disposed or retrievably stored? The RI/FS for 100-BC-1 makes it clear these items are disposed. The concern is that these may have to be dug up and sent to the LLBG. (RI)
38. Table 3-4: "⁵²Eu" should be "¹⁵²Eu." (editorial) (HAZWRAP)
39. p 3-15, Sec. 3.1.1.3, 2nd paragraph: It is apparent that outside of the sources located within the 100-BC-1 Operable Unit, the 118-B-6 burial ground is probably one of the larger potential sources of contamination

to BC-5. As such, this burial ground deserves more attention than one meager paragraph. The materials disposed of in this area are certainly leachable, a discussion on that possibility should be incorporated. (IT)

40. p 3-18, Sec. 3.1.2.1, 1st paragraph: The term quality is used here and in other locations in Sect. 3.1 to describe background levels of contamination. Soil quality has many different meanings such as those used to describe crop production, permeability, load bearing, and others. Quality is a term that should be avoided when describing components of the 100-BC area. (editorial) (HAZWRAP)
41. p 3-18, Sec. 3.1.2.2, 4th paragraph: Include summary statements regarding the results of soil sampling at specific sources in 100-BC-1. It may be beneficial to expand Sec. 3.1.2.2 as follows:
- Sec. 3.1.2.2.1 100-BC-1 Soil Contamination
-> This section would include summary statements and reference the 100-BC-1 Work Plan.
 - Sec. 3.1.2.2.2 100-BC-2 Soil Contamination
-> This section would include a discussion of the results pertaining to 116-C-2 pluto crib and sand filter sampling.
 - Sec. 3.1.2.2.3 100-BC-3 & 100-BC-4 Soil Contamination
-> As per existing 3.1.1.2.1, i.e., "No soil sampling ... (Dorian and Richards 1978)." (IT)
42. p 3-20, Sec. 3.1.3: It would clarify the discussion if a table listing what analytes have been run on the water samples was presented. This would help the reader to see which contaminants may be in the soil column (potential source terms) but not detected in the groundwater system. Also, it would help if the chemical data was presented graphically with time vs concentration so that trends already present in the concentrations can be viewed. (S&W)
43. p 3-23, 1st paragraph: Consistent usage of well names between tables and text are essential. The text lists wells as 199-B3-2 or 699-72-92 but tables present them as 1-B3-2 and 6-72-92, respectively. Change to consistent nomenclature or cross-reference. (IT)
44. p 3-23, 2nd paragraph: Text states that Table 3-11 is a summary of detected contaminants in groundwater at the site. Please provide by reference the complete list of parameters for which samples were analyzed. (HAZWRAP)
45. Table 3-12: Note monitoring time period which the data are representative of. (IT)
46. p 3-30, 1st paragraph: Give dates of maximum Cr^{+6} concentrations. (IT)
47. p 3-31, 1st paragraph: Re-write the 2nd sentence as "Although some temperature data prior to 1977 may have been recorded, it was not available for this initial evaluation. Based on data since 1977, it appears . . ." (editorial) (HAZWRAP)

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48. p 3-31, 2nd paragraph: The slightly higher temperatures at 699-72-88 are probably the direct result of the thermal plume created by the near-boiling effluent discharges during reactor operations. Mixing with surface waters of the Columbia may be occurring at this location; however, this mixing would tend to reduce temperatures of the groundwater, not increase them. (IT)
 49. p 3-31, Sec. 3.1.3.2, Temperature, 3rd and 4th paragraph: The conversion factors for Fahrenheit to Celsius have been applied erroneously. Where temperature differences occur and are referenced the conversion is a straight 1.8 degrees F per degree C. The converted values shown are as if the differences were absolute (above 0° C.). (IT)
 50. p 3-41, Sec. 3.1.5.1, 1st paragraph:
 - Divide the offsite stations into two categories: primarily upwind and primarily downwind. Compare for differences between their respective radionuclide averages, i.e., draw conclusions regarding the possibility of elevated background levels due to downwind contamination.
 - Make conclusive statement regarding air contamination associated with 100-BC areas and the Hanford Site. (IT)
 51. p 3-43, Sec. 3.1.6.1, 1st paragraph: Include summary statements for 100-BC-1 terrestrial biota. (IT)
 52. p 3-43, Sec. 3.1.6.2, 1st paragraph: Draw conclusion by comparing upstream and downstream sampling results to determine measurable effects from Hanford (if any). As before, paired sample comparison, using the Student t-test of differences and a 5 percent significance level may be used. (IT)
 53. p 3-46, 2nd paragraph: The usefulness of deeply rooted plants as potential indicators of groundwater contamination may be appropriate, however, depending upon the contamination source, plant species, and tissue samples, information of this type may have very little value to the RI/FS program. Expand on discussion, listing possible limitations. (HAZWRAP)
 54. p 3-48, 1st three bullets: Identify operable units for each of the bullets as done in bullet #4, e.i., 1st bullet - "(primarily the 100-BC-1 operable unit)". (editorial) (IT)
 55. p 3-48, 2nd paragraph:
 - A lot of very important source characterizations are presented in this paragraph in a repetitive fashion. A general comment concerning this approach is that the reader tends to become overwhelmed. Better organization and presentation, perhaps with more detail regarding each source, and more complete transition from one to another is in order. Care should be taken to present each source, originating from the operable unit (BC1, BC2, BC3, or BC4), and how it effects the groundwater operable unit being addressed in this work plan. Currently, the reader may become confused as to unit designation and interaction. Perhaps a

more effective presentation alternative would be to expand Section 3.1.7.1 into the following Subsections:

3.1.7.1.1 100-BC-1 Sources

- > Discuss radiological sources
- > Discuss non-radiological sources

3.1.7.1.2 100-BC-2 Sources

- > Discuss radiological sources
- > Discuss non-radiological sources

3.1.7.1.3 100-BC-3 Sources

- > Discuss radiological sources
- > Discuss non-radiological sources

3.1.7.1.4 100-BC-4 Sources

- > Discuss radiological sources
- > Discuss non-radiological sources (editorial) (IT)

■ The last two sentences of this paragraph should acknowledge the fact that the goal of the BC-5 Operable Unit RI/FS is to integrate and screen potential contaminant sources from all of the sources outside of BC-1. (IT)

56. p 3-50, 1st paragraph: Re-word sentence which states that water levels vary around 400 feet to assure that it cannot be interpreted as a 400 feet range of variability. (IT)
57. p 3-50, 3rd paragraph: Discussion of the formation of the hydrogeologic "conduit of flow" between Gable Butte and Gable Mountain is awkward. Re-write. (editorial) (IT)
58. p 3-50, 4th paragraph: Expand as per "Eight monitoring wells are completed in the upper saturated zone to provide monitoring of waste and contaminant levels in the unconfined aquifer". (editorial) (IT)
59. p 3-51, 1st Sentence: It seems unlikely that after 20 or so years that much contamination will be found in the upper high-permeability sediments in the BC-1 unit. It may be that only those contaminants that are currently leaching will be found there. It is likely that any remaining contaminants from past practices will be found in the lower portions of the unconfined aquifer, perhaps DNAPLS. (IT)
60. p 3-51, 2nd paragraph: Expand upon the discussion of the silty sand unit and include approximate permeability range believed to represent this layer. Follow with discussion of silt, sand, gravel layer below it before proceeding to the discussion of the local blue clay layer. (IT)
61. p 3-51, 3rd paragraph: Discuss in more detail the hypothesis of "pooling contamination" at the lower Ringold/blue clay contact. (IT)
62. p 3-51, 4th paragraph: Incorporate any other Hanford wells which suggest a continuous blue clay layer and upward vertical gradient. As is, with only 1 well for geologic information, the assumptions of an upward vertical gradient and continuous clay layer have large uncertainties associated with them. (IT)

63. p 3-51, last paragraph:
 - Reference Figure 3-14 for relationship of Ellensburg formation to other lithologic units.
 - boring B3-2 is completed in the Saddle Mountain Basalt according to Figure 3-14, not the Ellensburg formation. (IT)
64. p 3-51, last set of bullets: Include an additional bullet item - "Groundwater mounding as a result of effluent releases may have temporarily reversed the upward vertical gradient providing sufficient energy for the downward migration of constituents." (IT)
65. p 3-52, 2nd paragraph: Reorganize thoughts and present them in a less confusing manner. Also, provide references for Elephant Mountain flow interpretations. (editorial) (IT)
66. p 3-53, Sec. 3.1.7.4, 1st paragraph: A reference should be made to support the statement concerning spring discharges to the Columbia River. (HAZWRAP)
67. p 3-54, Sec. 3.2, Heading: The words "And-To-Be-Considered Materials" should be added to this heading to distinguish ARARs from TBCs. This distinction is important since, for example, formal waivers are necessary if ARARs are not met by the remedial action. On the other hand, no waivers are required if TBCs are not met. (HQ-EH)
68. p 3-58, Sec. 3.2.1.2, Washington Water Quality Standards (WAC 303-201):
 - 2nd Bullet Remove the word "not".
 - 4th Bullet WAC 303-201-080 indicates that for this stretch of the Columbia River temperature shall not exceed 20 C due to human activities not the 18 C as stated in this report. (S&W)
 - Include additional bullets from WAC-173-201-035(11) - Deleterious concentrations of radioactive materials for all classes shall be determined by the lowest practicable concentration attainable and in no case shall exceed:
 - (a) 1/100 of the values listed in WAC-402-24-220, or
 - (b) USEPA Drinking Water Regulations for radionuclides, as published in the federal Register of July 9, 1976, or subsequent revisions thereto. (IT)
69. p 3-62, Sec. 3.2.4, Heading: This heading should be revised to "To-Be-Considered Materials" to more accurately reflect the nature of this section. (HQ-EH)
70. p 3-62, Sec. 3.2.4, 2nd paragraph: The risk range cited in this paragraph should be consistent with Section 300.430(e)(2)(i)(A)(2) of the National Contingency Plan (NCP) which defines the generally acceptable upper bound life time cancer risk as between the 10^{-4} and 10^{-6} risk level. (HQ-EH)
71. p 3-62, Sec. 3.2.4, last paragraph: This paragraph regarding MCLGs should be moved under Section 3.2.1.1 (within the ARAR discussion).

MCLGs are in fact potential ARARs for groundwater (See Section 300.430(e)(2)(i)(B) and (C) of the NCP). Accordingly, MCLGs should be added to Table 3-22 on page 3-56. (HQ-EH)

72. Table 3-22: The table needs to have the units identified. (S&W)
73. p 3-64, 1st paragraph: This statement implies that the conceptual model and its subsequent sampling must be understood before the remediation alternatives can be developed. There currently exists only a limited number of remediation techniques that can be applied to removal or stabilization of radionuclides and radioisotopes in groundwater. These techniques have specific data requirements that must be satisfied before a decision can be made concerning the most appropriate remediation strategy. In this instance, the investigation is guided by the specific information to support the FS. (HAZWRAP)
74. p 3-65, last set of bullets: Include - "Inhalation of volatilized organic constituents while showering with contaminated groundwater." (IT)
75. p 3-66, Sec. 3.3.2, 1st paragraph: Construct and refer to a summary table that lists constituents believed to contaminate the soil and include potency factors, reference doses, transfer coefficients to plants, meat, milk, fish. This approach will outline the toxicity of constituents likely to be encountered and provide a foundation for evaluating potential adverse effects and uncertainties. (IT)
76. p. 3-66, Sec. 3.3.2.1, 1st paragraph: An explanation should be given as to how this dilution factor was derived because this is an important factor for bringing contaminants below toxicity standards. (HQ-EH)
77. p 3-67, 1st paragraph: Elemental mercury cannot be "degraded." (HAZWRAP)
78. p 3-68, 1st paragraph: Copper is not represented in Table 3-25 but is discussed at length in this paragraph. Recommend that it be included in Table 3-25. (HAZWRAP)
79. Table 3-26: Include in the Table the ARARs for each of the constituents for readily available comparison. (IT)
80. p 3-69, Sec. 3.3.2.4, 1st paragraph: Reference source for bioconcentration factors. (IT)
81. p 3-70, Sec. 3.3.4.1, 1st paragraph: Add narrative discussion which clarifies which data represent present-use and future-use assessments. (IT)
82. p 3-71, first two sentences - All ARARs should be described as "potential" until formally determined later in the RI/FS process. (HQ-EH)

83. p 3-71, Sec. 3.3.4.2, 1st paragraph: Provide data, calculations, references, and discussions which led to this conclusion. (IT)
84. p 3-72, Sec. 3.4.2, last paragraph: - This sentence should cite the new NCP at the appropriate section (Section 300.430(e)(6)). (HQ-EH)
85. Figure 3-1: The symbol for a septic tank and drain field should be included in the legend because there is one present on the map (+124-C-2) and in the discussion on p 3-15. (HQ-EH)
86. Figure 3-6 and 3-7: Well nomenclature is not consistent between Figure title, legend, and text. (IT)
87. Figure 3-13:
■ Zero arrowheads depicted on AIR to SURFACE WATER component.
■ In this figure, shaded areas indicate activities associated with 100-BC-1 OU, yet, significant components such as process effluents, other sources, infiltration, overland flow, etc., are not shaded. (IT)
88. Figure 3-15: This figure could be improved by:
1. Supply more flow direction data on the figure.
 2. Use a different line weight for the arrows showing the location of areas.
 3. This figure reference itself. Remove the reference. (IT & S&W)
89. p 4-1, Sec. 4.1, 2nd paragraph: Indicate that to support development and evaluation of remedial alternatives are the prime objectives. The other objectives are to support this effort. (HAZWRAP)
90. p 4-2, Sec. 4.1.1, last paragraph: Discuss information regarding waste generation during the post-reactor period, i.e., during the last twenty years. (S&W)
91. Page 4-4, Section 4.1.2: Because acetone is a common laboratory contaminant, and acetone was detected in a well does not imply that acetone is not in the water. Laboratory replicates samples should be checked to see if this is a laboratory contaminant. If it is a laboratory contaminant then do not discuss. (S&W)
92. p 4-10, Sec. 4.2.2: Data gaps are identified in Section 4.1.3, not Section 4.1.2 as stated. (IT)
93. p 4-10, 1st paragraph: Present the data or reference former studies which support the declining release rates since reactor operations have been terminated. (S&W)
94. p 4-11, 2nd paragraph:

- A map reference should be cited; the map should show the 100 B/C area, the rest area, and groundwater flow direction. (HAZWRAP)
- The limited information available indicates that it is unlikely that the plume could reach the existing well. It may be better to indicate that the well will be sampled, rather than say it may be contaminated (IT, S&W)

95. p 4-11, Sections 4.2.4 and 4.2.5: These sections need to be expanded to include the specifics of just how data will be integrated and forwarded to other OUs. Which wells will be in what OU, how samples will be handled, how data will be developed under BC-5 be transferred to BC-1 and vice versa, etc. (IT)
96. p 4-12, Section 4.2.6, 2nd Paragraph:
- Refers the reader to questions listed in Section 4.1.2; however, the section does not list any questions. List the correct section that contains the questions or modify the sentence. (S&W)
 - Discuss the tasks for Phase 1 and 2 and how they integrate into 100-BC-1 investigation's time table. Please list the tasks for the two phases and show a diagram for the integration of the two operable units. (S&W)
97. p 4-12, Sec. 4.2.7: Suggest including in this section of Data Quality Strategy some discussions of critical samples. Samples which are determined to be critical for data use such as risk assessment should undergo the highest level of QA/QC. These samples should be defined in the Sampling and Analysis Plan so the selection is not determined by the field crews. Note that the number of critical samples may exceed 10% of all samples. (HAZWRAP)
98. p 4-15, Sec. 4.2.9: Heading should read "Data Quality Objectives." (HAZWRAP)
99. p 4-22, 2nd paragraph: Discuss ramifications and line of action if the 10% validation analyses differ from the field screening results. (IT)
100. p 4-23, Sec. 4.2.10.2:
- Expand upon staged-well construction in an effort to make the reviewer comfortable that cross-contamination will not occur. It is very possible that tritium contamination in the Ellensburg formation is a direct result of drilling through the blue clays; therefore, it is essential that proper safeguards are in effect to prevent possible recurrence. (IT)
 - Include discussion of interaction of tasks for source operable units 1, 2, 3, and 4 with 100-BC-5 and how much of this task (three bullet items) will be performed in conjunction with 100-BC-1, for example. Details of source investigations can be referenced from the 100-BC-1 Work Plan. (IT)
101. p 4-24, Sec. 4.2.10.4, last paragraph: Include discussion of how bullet items interact with similar tasks of 100-BC-1 and, therefore, will be conducted concurrently whenever possible. (IT)

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102. p 4-25, 1st paragraph: Expand discussion on geophysical methods to be used. (HAZWRAP)
 103. p 4-26, last paragraph: Paragraph is incomplete and cannot be properly reviewed. (editorial) (IT)
 104. p 4-28, 2nd paragraph: Since reducing waste from drilling operations is highly desirable at this site it is recommended that multilevel well completions be installed at the proposed well cluster locations. Installing a multilevel system like the Westbay system will mean that only one borehole has to be drilled at each of the four well cluster locations. This will significantly reduce drilling waste, time, and associated costs. (HAZWRAP)
 105. p 5-2, Sections 5.1.3 and 5.1.4: Expand sections to discuss the control processes. (HAZWRAP)
 106. p 5-3, 1st paragraph: This section needs to be expanded to include the data delivery requirements of the TPA. These requirements have been around for some time and need to be recognized here. (IT)
 107. p 5-4, Sec. 5.3.1.1, 2nd Paragraph: The vertical accuracy of + or - .1 ft is not acceptable accuracy for vertical control on the monitoring wells. The specified vertical accuracy for surveyed casing is + or - .02 ft. (S&W)
 108. p 5-5, Sec. 5.3.1.3, 1st paragraph: Clarify that source data compilation will focus on gathering information of sources in operable units BC2, BC3, and BC4 because of the exhaustive effort being simultaneously conducted on sources in operable unit 100-BC-1. Results of the OU BC1 study will be incorporated with information gathered during investigations of BC2, BC3, and BC4 to extensively characterize all sources which may contribute to the groundwater operable unit. (IT)
 109. p 5-5, Sec. 5.3.2: Discuss possible locations and rationale for the initial phase monitoring well installation. Are these locations dependent upon the results of Task 1? If so, how? (IT)
 110. Page 5-5, Section 5.3.2: If the objective of the first sample is to measure surface contamination why was the depth of 10 feet chosen rather than 0-2 ft ? Is the sample 8-10 ft or 10-12 ft? The rationale for the 25 ft sample is given as a determination of contamination below waste disposal units; however earlier it was stated that wells would be located in areas of assumed low contamination, to avoid drilling through waste areas.

Please explain how the determination was made that the groundwater mounding was within the range of 2-5 ft above the water table.

It may be also beneficial to take a sample at the groundwater interface, to determine if contaminants have fluctuated due to seasonal variations with the river.

- 9 2 1 2 5 4 8 1 6 3 3
111. Table 5-1: Vadose zone soil samples should also be analyzed for plutonium-238 (²³⁸Pu). (HAZWURAP)
112. p 5-7, Sec. 5.3.3, bullet items:
- Add "upper contact" before "... of the blue clay ..." in the 2nd bullet. (editorial) (S&W)
 - Provide locations for well placement by referencing Figure 5-1. (IT)
 - Provide justification for number of wells to accomplish each objective. (IT)
 - While the "corner approach" for confirming the presence of the blue clay unit is certainly plausible, it may not be the most appropriate. For example, there has already been some discussion involving the thinning or absence of the blue clay. With this in mind, a more suitable approach may be to drill at three corners and one "target" well placed in the area of concern. (IT)
 - It is unlikely that these three wells will be able to result in solution of a three-point structural problem. The basalt in much of the area is eroded, leaving an uneven surface. Without assurance of where in a given flow or even if the same flow is being sampled, there is no sure way of providing this dip information. (IT)
113. Page 5-8, 2nd paragraph: The reference to Attachment 1, Part 1 is inappropriate. The reference is only to a 4 or 5 line paragraph. It would be superior to refer directly to the appropriate EII. (IT)
114. Page 5-8, Sec. 5.3.3.1: The reference to ISV should be for the 116-B-3 crib. (IT)
115. p 5-9, Sec. 5.3.3.3, 3rd paragraph:
- List the spacing between geophysical lines and the spacing between stations for EMI and Magnetometer survey. (S&W)
 - An EM31 device will require closer control than 25 foot centers, i.e. will have to be on 10 foot centers to get the resolution one needs for pinpointing suspicious or near surface contamination to avoid in planning a drill site. (S&W, HQ-EH)
116. p 5-9, Sec. 5.3.3.3, 4th paragraph:
- Discuss rationale for collecting the samples at a depth of 7 feet. (HAZWURAP)
 - The FSP does not describe the compositing of samples under the Drill Site Evaluation heading. Please refer to the proper place in the FSP. (IT)
117. p 5-9, Sec. 5.3.3.3, 5th paragraph: Provide the rationale for or objective of collecting four composite surface soil samples at each drill location. (IT)
118. p 5-10, Sentence 1: All of the wells listed in the referenced table are within the confines of the BC-5 OU. It is advisable to place some limited number of wells outside those boundaries to cover the multitude of upgradient and downgradient relationships. (IT)

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119. Page 5-11, Section 5.3.3.4, top of page: Please indicate from what depth samples for physical characteristics should be taken. Other sampling intervals are based on expected contamination areas. Physical characteristics intervals should be chosen based on lithologic variation. (S&W)
120. p 5-11, 1st paragraph:
- Include - "(except 199-B1-10 which will be continuously drive sampled or cored)." (IT)
 - Please define the level of characterization that will be carried out on a continuous basis. Most wastes will be in the upper Vadose zone; therefore, sampling at 10 foot intervals will miss most potential contamination. (IT)
 - Geophysical logs are only called for at the deep boring locations. This is inadequate. Geophysical logs should be run whenever possible to aid in the ample characterization of the hydrostratigraphic framework. The geologic section as currently known has considerable variation on a lateral basis and prediction of continuity of units cannot be predicted without additional correlation aids. (HQ-EH)
121. p 5-11, Sec. 5.3.4, 1st paragraph: Discuss criteria which determine the conceptual model to be satisfactory. (HAZWRAP)
122. p 5-11, Sec. 5.3.4, 2nd paragraph: It was not apparent that the RI/FS Work Plan was intended to provide more regional or programmatic data that will be used to establish a broader conceptual model of the 100 Areas. This seems to be a secondary agenda not identified in Sect. 1.0. Please clarify. (HAZWRAP)
123. Page 5-12, Sec. 5.3.3.4, Para 1: Referring to a "Hydrogeologic geologic" model is redundant. (editorial) (IT)
124. p 5-17, 1st paragraph: Geologic samples should be sampled and described at 5 foot intervals instead of 10, particularly in a section that varies as much as this one. (HQ-EH)
125. p 5-17, Sec. 5.3.4.5: Provide a design drawing of a typical completed well installation for reference. (HAZWRAP)
126. p 5-18, Sec. 5.3.4.7, 1st paragraph: This section states that pressure transducers will be placed in four monitoring wells and in the Columbia River for the purpose of collecting continuous water level data. Pressure transducers will not work in an open body of water. Please clarify how this will be done. Given the data need the use of Stevens type continuous water level recorder will provide the same data at a considerable cost savings. Recommended using this type of recorder unless there is some data need which a pressure transducer is uniquely capable of providing. (HAZWRAP)
127. p 5-19, 2nd paragraph: If the intent of this sampling scheme is to assess the seasonal differences in water quality, then it seems advisable to analyze for the full spectrum of analytes for the one-year

(4 sample) period. Changes in water level may result in changes in the make up of the water chemistry. Additional justification for the proposed approach is needed. (IT)

128. Table 5-4:

- Differentiate between existing wells and well to be installed during Phase I with an asterisk superscript and footnote.
- Determine whether the existing wells planned for use have been examined for usability. Discuss the results if the study has been conducted or discuss possible impacts and alternative plans if the study is later conducted and establishes some of the wells as "unusable". (IT)

129. p 5-27, Sec. 5.3.5.3, 1st paragraph: This is the first reference to the "fixed" sample locations shown in Figure 5-5. As written, it gives the impression that the 5 "fixed" locations have already been discussed. Introduce and discuss the fixed locations and their purpose - referencing Figure 5-5 for orientation. (IT)

130. p 5-28, Sec. 5.3.5.3.2, 1st paragraph: The extension of the surface water sampling transects to mid-stream is extreme. Suggest reducing the length of the transects to conform with the plan already put forth for the HR-3 OU. (IT)

131. p 5-28, Sec. 5.3.5.3.2, 2nd paragraph: Discuss the criteria which establish representative material. (HAZWRAP)

132. Page 5-29, Sec. 5.3.7: The BC-5 Biotic Investigation should be revised to conform with the studies described in the HR-1, HR-3 and DR-1 OUs. This will provide a reduced scope yet complete approach to the problem of Biological Surveys. Consistency between Work Plans is essential. (IT)

133. p 5-34, 1st paragraph: Define conservative and nonconservative contaminants. (editorial) (IT)

134. p 5-34, 2nd paragraph: "together and separately" is confusing as presented. Please re-word. (editorial) (IT)

135. p 5-37, Sec. 5.3.9.4, 2nd paragraph: The risk range cited in this paragraph should be consistent with Section 300.430(e)(2)(i)(A)(2) of the National Contingency Plan (NCP) which defines the generally acceptable upper bound life time cancer risk as between the 10^{-4} and 10^{-6} risk level. (HQ-EH)

136. p 5-37, Sec. 5.3.9.4, Para. 6: The description of how the "No Action" alternative will be handled does not appear to be in concert with the EPA guidance. The no action alternative is always addressed, so that other alternatives may be compared to it. (IT & HQ-EH)

137. p 5-41, 5th paragraph: This paragraph should be revised to be consistent with Section 300.430(e)(5) of the NCP which states that innovative treatment technologies shall be developed for further consideration if

they"...offer the potential for comparable or superior performance or implementability; fewer or lesser adverse impacts than other available approaches; or lower costs for similar levels of performance than demonstrated treatment technologies." (underscore added). (HQ-EH)

138. p 5-41, Section 5.45: For the groundwater component, a limited number of alternatives should be developed that achieve clean-up goals within different time periods by utilizing one or more different technologies, as stated in Section 300.430(e)(4) of the NCP. I also suggest that you give consideration to developing a separate set of remedial alternatives for each medium - one for the secondary source medium (sediments) and one for the groundwater medium - which would proceed through separate screenings and later detailed analyses. This would avoid analyzing excessive numbers of permutations of alternatives. (See EPA's October 1988 RI/FS Guidance, Section 4.2.6) (HQ-EH)
139. p 5-47, Sec. 5.5.3.3, 1st paragraph:
- Include "In addition, potential future remedial action costs will be included to the extent they can be determined. Present worth analyses ..." (IT)
 - The role of cost in screening should be stated in this section and should be consistent with Section 300.430(e)(7)(iii) of the NCP (e.g. alternatives may be screened out that will have costs grossly excessive compared to the overall effectiveness of the alternatives, or which provide similar effectiveness and implementability as another alternative employing a similar treatment method or engineering control but at greater cost). (HQ-EH)
140. p 5-47, Sec. 5.5.3.4, 1st paragraph: Add "The need for treatability studies on any retained innovative technology will be determined as early in the process as possible to avoid delays in the RI/FS schedule." (editorial) (IT)
141. p 5-57, Sec. 5.7.2.2: The degree of permanence each alternative affords should also be discussed in this section in accordance with Section 300.430(e)(9)(iii)(C) of the NCP. (HQ-EH)
142. p 5-58, Sec. 5.7.2.5, 1st paragraph:
- Add at the end of paragraph - "If there exists sufficient uncertainty concerning specific assumptions of the cost estimate, sensitivity analyses will be performed. The results of the sensitivity analyses will be included during the comparison of alternatives. (editorial) (IT)
 - Analysis of the cost criterion in the detailed analysis of alternatives should be an estimation of costs of each alternative and not a determination of cost effectiveness (see preamble to NCP, F.R. Vol. 55, No. 46, page 8722, March 8, 1990). Cost effectiveness is determined in the remedy section phase as is described in Section 300.430(f) (ii) (D) of the NCP. This sentence is not relevant to evaluation of the cost criterion in the detailed analysis of alternatives and therefore should be deleted. (HQ-EH)

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143. p 5-58, Sec. 5.7.2.6, 1st paragraph: This subtask should also provide grounds for invoking any of the waivers under 300.430(f)(1)(ii)(C) of the NCP, if appropriate. (HQ-EH)
144. p 5-59, Sec. 5.7.3, 1st paragraph: Discussion of the threshold, balancing, and modifying criteria has been removed from the detailed analysis of alternatives in the NCP (see the preamble to the NCP, F.R. Vol. 55, No. 46, page 8719, March 8, 1990). This sentence should therefore be revised as follows: "An assessment of whether the alternative provides adequate overall protection of human health and the environment and whether the alternative complies with ARARs, or provides grounds for invoking a statutory waiver, will be provided for each alternative." (editorial) (HQ-EH)
145. p 5-59 and 5-60, Subtasks 3a through 3d: These tasks are not required for the comparative analysis of alternatives under EPA's RI/FS guidance or the NCP and are appropriate to the screening phase only. These tasks should therefore be deleted. (HQ-EH)
146. Figure 5-4 and FSP-3: These figures describe a method of well completion that will set new standards for drilling costs at Hanford. Those drilling costs are already deemed as too costly. The completion method should be scaled back to the basic Hanford "RCRA Compliant Well". (IT)
147. p 6-1, Sec. 6.0:
- Distinguish which of the bullet assumptions are part of the critical path.
 - Include discussion on interactive and simultaneous completion of tasks under 100-BC-1 and 100-BC-5.
 - Discuss possible fatal flaws and impact on the schedule. (IT)
148. p 8-4, last reference: "PBC" should be "PCB". (HAZWRAP)
149. p FSP-3, Sec. 2.3: Field blanks, equipment blanks and trip blanks should be prepared using analyte-free water containing <50 mg/L of volatile organic compounds as detected by low level GC scan. Volatile organics may be included for analyses with other contaminants of interest, and deionized distilled water is generally not of sufficient quality to preclude interference with these analyses. (HAZWRAP)
150. p FPS-3: There are several differences between the QC samples specified in this section as compared with other sampling programs. The significant differences are as follows:
- Field duplicate samples are typically collected at a rate of 10% instead of the proposed 5%.
 - Field blanks are collected for the purpose of checking decon water and are collected at a rate of one sample/sampling event (each 10 day work shift).
 - Equipment blanks are collected either every day or every other day.
 - Trip blanks are only necessary in shipping containers which carry other VOC samples. (HAZWRAP)

151. p FSP-5, Sec. 3.2.3, 2nd paragraph: No soil gas surveys have been proposed in the work plan. Delete this reference. (S&W)
152. p FSP-6, Section 4.0: Section 5.3.3.3 calls for "4 composite surface solid samples (approximately 7ft deep) will be collected and analyzed at each drillsite." No reference is made to the collection of these soil samples in this section. (S&W)
153. p FSP-8, Sec. 4.6, 2nd paragraph: Soil sample identification code is given as 199-B10-1D/10/SS does not report depth of sample to the nearest tenth of a foot as described. If sampling nomenclature rounds to the nearest foot for brevity, include this explanation in the narrative. (IT)
154. p FSP-8, Sec. 4.6, 3rd paragraph and p FSP-16, Sec. 5.6, 3rd paragraph: Discuss provisions, exceptions, levels of effort, etc., required to convert anticipated nomenclature and designations in the event Westinghouse Hanford procedures are implemented during the project life. (IT)
155. Table FSP-3: Container requirements should specify the type of closure (cap) for each container. Teflon-lined closures are preferred. (HAZWAP)
156. p FSP-11, Sec. 5.3, 3rd paragraph: Discuss effects of buildings, access routes, traffic, etc. on location grid points. (IT)
157. p FSP-12, Sec. 5.3.1, 2nd paragraph:
■ Discuss the effects nearby buildings, radio towers and transmitters, microwave stations, etc., may have on EMI results.
■ Discuss efforts necessary to minimize or eliminate those affects. (IT)
158. p FSP-12, Sec. 5.3.2, 3rd paragraph:
■ Discuss possible influences by outside forces such as power lines, radio transmissions, etc., that may affect GPR studies.
■ Discuss efforts necessary to minimize or eliminate those affects. (IT)
159. p FSP-13, Sec. 5.3.3, 3rd paragraph:
■ Discuss limitations of vehicle mounted system such as impossible terrain, etc.
■ Discuss backup procedures and schedule impact if system malfunctions or breaks down. (IT)
160. p FSP-13, Sec. 5.4.1, 1st paragraph: Discuss approximate depths of those wells to be completed in units A, B, and C. (IT)
161. p FSP-14, Sec. 5.4.2, 1st paragraph: State that all wells drilled during 100-BC-5 characterization will be logged. (IT)

162. p FSP-14, Sec. 5.4.3, 1st paragraph: Expand discussion of geophysical logging by providing details on natural gamma, gamma-gamma, and neutron-epithermal neutron purposes, techniques, and advantages. (IT)
163. Table FSP-5: The USCS soil classification system, while used elsewhere, has not been adopted at Hanford. To maintain a transferability of data, the proposed system should be the Wentworth soil classification system. (IT)
164. p FSP-16, Sec. 5.5, 1st paragraph: Expand discussion to include appropriate actions taken by sampling and screening personnel based upon results of field screening. Additionally, the authors do not seem to be aware of the problems associated with alpha radiation screening of samples destined for moisture content determination. (IT)
165. p FSP-18, Sec. 6.4.1: The designation of well numbers should (has to be) consistent with the numbering system used site-wide. Revise the section accordingly. (IT)
166. p FSP-19, Sec. 6.4.2, 1st paragraph: Discuss rationale used in deciding upon number and location of Phase I wells. (IT)
167. p FSP-19, Sec. 6.4.3: This section should be revised to provide consistency with proven methods at Hanford, this is particularly true of telescoping casings. The Becker method is limited in the diameter of the holes which it can drill, so the proposed plan cannot be done via that method. Suggest review of the Engineering Analysis by Kaspar and Myers as background for this section. (IT)
168. p FSP-21, Sec. 6.7, 1st paragraph: Discuss whether existing wells have been examined for usability and possible impacts that may result from such a study. (IT)
169. p FSP-21, Sec. 6.8.1, 1st paragraph: Based on current information, estimate which months are representative of seasonal high and low groundwater levels. (IT)
170. p FSP-21, Sec. 6.8.2, 1st paragraph: Reference EII for sample identification protocols or expand to adequately discuss all items. (IT)
171. Table FSP-6: Distinguish between new-construction and existing wells by including an asterisk superscript and footnote. (IT)
172. p FSP-23, Sec. 6.8.4, 3rd paragraph: Include discussion which outlines appropriate actions taken by sampling and screening personnel based upon results of field screening. (IT)
173. Table FSP-11: Container requirements for TCL volatile organics should specify Teflon-septum closures on vials. Containers for additional TCL and TAL analyses should specify Teflon line closures. (HAZWRAP)
174. p FSP-32, Sec. 7.3.2.1, 1st paragraph: State that this determination is made based on the results of the surveys conducted by the HPTs. (IT)

175. p FSP-32, Sec. 7.3.2.2, 1st paragraph: Discuss rationale for determining the 10 to 20 feet from shoreline and maximum water depth of 4 feet restrictions. (IT)
176. p FSP-36, 1st paragraph: List example organisms of periphyton, macrophytes, and benthic invertebrates. (IT)
177. p QAPP-2, Sec. 1.4: Include discussion of intended use of the acquired data. (IT)
178. Table QAPP 3-1: Provide clarification as to why the Radionuclides section shows "Westinghouse" for analytical method, precision, accuracy, completeness, and target detection limit for the listed parameters. (HAZWRAP)
179. p QAPP-10, Sec. 4.2.3, 1st paragraph: Reference applicable section numbers in the FSP. (IT)
180. Table QAPP 4-1: Provide clarification as to why the methods for radionuclides, oxalate, and sulfamate indicates "Westinghouse". (HAZWRAP)
181. Table QAPP 4-2:
 - EII 1.3, Preparation and Control of Desk Instructions, is denoted with the superscript "c" which is shown in the legend as "cancel". If this instruction is to be cancelled, what is the purpose of showing it in the table? Is it to be replaced? Please clarify.
 - EII 1.4 is shown as applicable to tasks 1, 5, 6, and 7. Does this mean that there will be no deviation allowed for these tasks? Please clarify.
 - The legend shows M&TE = but does not show what it is equal to. Please clarify. (HAZWRAP)
182. p HSP-32, 3rd paragraph: Detail and reference skin decontamination procedures. (IT)
183. p HSP-33, Sec. 4.13.2, 1st paragraph: Add "Appropriately-sized decontamination pads (reference example construction as-built drawing) will be constructed and utilized for field decontamination of drilling and excavation equipment." (IT)
184. p HSP-33, Sec. 4.13.2, 3rd paragraph: Discuss the necessary precautions to be implemented that will assure that the transportation of contaminated equipment will not lead to the contamination of "clean areas". (IT)
185. p HSP-33, Sec. 4.13.3, 2nd paragraph: Reference guidance document which governs "regulated equipment". (IT)
186. p HSP-36, Sec. 5.3.2, 1st paragraph: Discuss precautions to be taken to assure that operation of vehicle-mounted survey equipment will not ignite the prairie grass. (IT)

187. p HSP-39, Sec. 5.5.2, 2nd paragraph:
■ Include discussion of vehicle (boat, barge, etc.) used by the field crew to obtain surface water samples.
■ Include discussion of personnel buoyancy equipment (life jackets, floating cushions, etc.) to be used by each member of the field team. (IT)
188. p HSP-40, Sec. 5.7.2, 1st paragraph: Field sampling activities for aquatic and riparian biota investigations will require workers to conduct field exercises on relatively steep river banks. Discuss procedures and precautions regarding tie-lines, life-jackets, etc. (IT)
189. p HSP-42, last paragraph: Discuss circumstances and corresponding chain-of-command under which either the site safety officer or the site emergency coordinator must invoke emergency response procedures; notify Hanford patrol; activate the Emergency Management Center; and/or the DOE Emergency Action Coordinating Team. (IT)
190. p PMP-2, Sec. 2.2.2, 3rd paragraph: Expand upon and list issues for which Ecology retains authority. (IT)